Space Weather Technical Forecast

Issued on Monday, 21 March 2022 at 00:47 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity currently expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with occasional C-class flares, the largest a C4 flare from ex-2971 at 20/0745 UTC which also produced a CME. There are currently two numbered sunspot regions on the visible disc. AR2972 (Beta/Bxo) in the south, approaching centre disc, is unchanged in its overall configuration. AR2973 (Beta/Bxo) in the northeast, contains small weak spots waxing/waning. There is currently one other small and weak sunspot located in the southwest quadrant, currently un-numbered.

The CME associated with the C4 flare on 20th looks directed north and east of the Sun-Earth line, so an Earth directed component seems unlikely. However, modelling results are still pending at the time of writing. No other Earth-directed CMEs were observed on available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by DSCOVR at L1, remained at background levels, in the range 290-330 km/s. Density was above average before settling at average levels later the period, with a peak of 23ppcc. The IMF, Bt, was weak to moderate, 7-10 nT, with the north-south component, Bz, ranging between +9/-7 nT. Phi angle was negative (towards the Sun) until the afternoon/evening on the 20th when it turned largely positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background. The high energy electron flux (greater than 2 MeV) has been at generally background levels, peaking at 161 pfu at 20/1935 UTC. The 24-hour integrated electron fluence was well below the Active (1e8 integrated pfu) threshold, with a steadily declining trend. Observed fluence at 20/0000 UTC was 1.22e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to continue predominantly Very Low or Low through the period, given the current sunspot configuration.

Solar Wind / Geomagnetic Activity: Background solar winds are likely to continue in the short-term, however there may still be some enhancement from CH66/- during the next 24 hours, although confidence is low. By day 4 (24 March) CH67/+ may become geoeffective, perhaps with a higher chance of some faster solar wind. The CME associated with the C4 flare on 20th looks directed largely north and east of the Sun-Earth line, so an Earth directed component seems unlikely. However, modelling results are still pending at the time of writing.

Geomagnetic activity is expected to be mostly Quiet (Kp 0-2), with occasional Unsettled periods (Kp 3), these most likely to be associated with any coronal hole interaction on days 1 and 4. This would also carry a slight chance for an isolated Active (Kp 4) interval.

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Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain predominantly at background levels. The high energy (greater than 2 MeV) electron flux is also currently at predominantly background levels. Further enhancement in the near term is unlikely. There is still the possibility of coronal hole interaction day 1 (21 March), however confidence is low. The next potential enhancement may come from another small coronal hole on day 4 (24 March), but this is also unlikely to raise electron levels enough to reach the Active fluence threshold (1e8 integrated pfu) in the forecast period.

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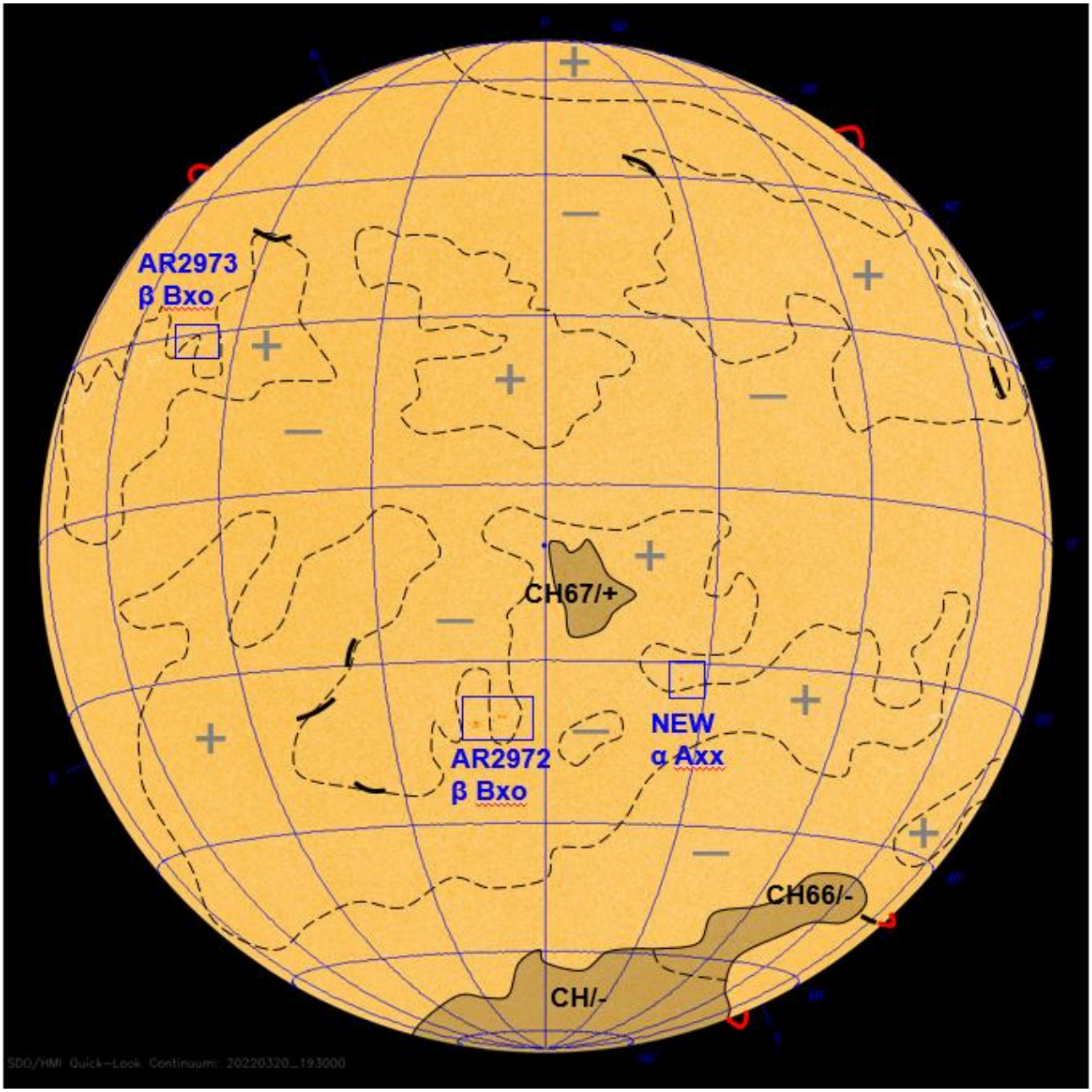
Figure 1. Solar Analysis Valid 20/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds are currently at background levels, near 320km/s. There may still be some enhancement from CH66/- during the next 24 hours, although confidence is low. Beyond this CH67/+ may become geoeffective on day 4 (24 March). The only other possible enhancement at present could be a glance from the CME associated with the C4 flare on 20th. The ejecta looks directed north and east of the Sun-Earth line, so an Earth directed component seems unlikely. However, modelling results are still pending at the time of writing.

Overall, geomagnetic activity is expected to be mostly Quiet (Kp 0-2), with occasional Unsettled periods (Kp 3), these most likely to be associated with any coronal hole interaction on days 1 and 4. This would also carry a slight chance for an isolated Active interval.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None currently expected.

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Radio Blackouts - X-Ray Flares:

Solar activity has been Low over the past 24 hours, with occasional C-class flares, the largest a C4 flare from ex-2971 at 20/0745 UTC. There are currently two numbered sunspot regions on the visible disc. AR2972 (Beta/Bxo) in the south, approaching centre disc, is unchanged in it's overall configuration. AR2973 (Beta/Bxo) in the northeast, contains small weak spots waxing/waning. There is currently one other small and weak sunspot located in the southwest quadrant, currently un-numbered.

STEREO-A imagery shows a brighter area of flux just beyond the southeast limb, which will be monitored for any potential spot group turning onto the visible disc over the next few days. Solar activity is forecast to continue predominantly Very Low or Low through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES-16 is currently at background levels, and is expected to remain at this level.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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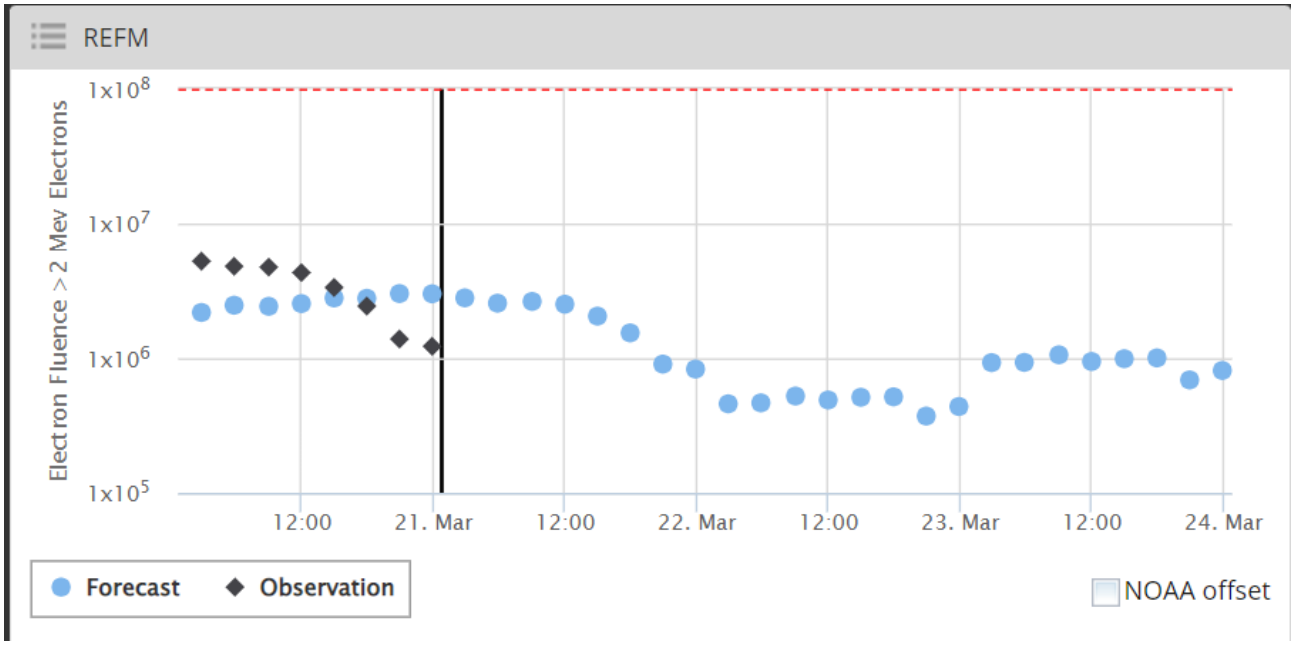
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux as observed at GEO by GOES-16 is currently at predominantly background levels, with any significant enhancement in the near term unlikely. There is still the possibility of interaction with CH66/- on day 1 (21 March), however confidence is low. The next potential enhancement may come from CH67/+ on day 4 (24 March), but this is also unlikely to raise electron levels enough to reach the Active fluence threshold in the forecast period.

The general trend on REFM is currently assessed as ok to follow for now.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	5	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 2: MOSWOC REFM.



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